

New Product Development: A Study of Hi-Tech Firm in Taiwan

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Abstract. This study observes the comparison of new product development performance among two groups of hi-tech firms (older and young firms). Four factors influencing NPD successes are determined in this study namely business network, product innovation, process innovation, and R&D capability. Using data from 13 firms in Taiwan (i.e., semiconductor and telecommunication), this study uses a key-informant survey design that was randomly selected from researcher networks. Applying 2-sample T test, it reveals that only business network shows significant difference, while the remaining factors show no significant differences.

Keywords: Business network, Hi-tech, NPD, Product innovation, Process innovation, R&D

Abstrak. Studi ini bertujuan untuk mengobservasi perbandingan kinerja pengembangan produk baru terhadap dua grup perusahaan berteknologi tinggi: (i) perusahaan lama/ pemain lama, (ii) perusahaan baru/ pemain baru. Empat faktor yang berpengaruh terhadap kinerja pengembangan produk baru adalah jaringan bisnis, inovasi produk, inovasi proses dan kemampuan pengembangan riset. Melibatkan 13 perusahaan di Taiwan (misalnya semikonduktor dan telekomunikasi), studi ini menggunakan ahli kunci sebagai responden kuesioner yang dipilih secara acak dari jaringan penulis. Dengan mengaplikasikan 2-sampe T test, didapatkan hasil bahwa hanya jaringan bisnis yang berbeda secara signifikan antara pemain lama dengan pemain baru, sedangkan faktor lainnya tidak berbeda secara signifikan.

Keywords: jaringan bisnis, teknologi tinggi, pengembangan produk baru, inovasi produk, inovasi proses, pengembangan riset

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1. Introduction

New product development (NPD) plays a critical role in hi-tech firm's performance in emerging market (Lestari, 2014). As one of emerging market, Taiwan's hi-tech manufacturers have been actively pursuing for the past 20 years. One of the most successful is the personal computer of information industry and the other is wafer foundry in the semiconductor industry. These are the two foundations of Taiwan high-tech industry (Lin, 2009). Furthermore, Taiwan government even developed policies and guidelines for boosting up the hi-tech industry performances particularly for five emerging industries that are the most worth to investment and development: electronic industry (semi-conductor and display technology), communication (optical communication and wireless communication), information service, biological technology and nano-technology (Lin, 2009).

Nevertheless, with rapid changing business environment, Taiwan's manufacturers are challenged for creating value through new product development (Liu and Tsai, 2007). Related to this, this study aims to observe the different challenges faced by the Taiwan manufacturer's overtime. Factors influencing NPD success consists of business network, product innovation, process innovation, and R&D capability. By involving totally 13 firms in Taiwan (i.e., semiconductor and telecommunication) which classified into two groups (older and young firms), this study applies apply 2-sample T test to observe the significant difference among two groups.

2. Literatures and Research Hypothesis

Many publications have studied the NPD issue. With respect to Lestari (2014), most of studies underline the importance of Research and Development (R&D) capability, innovation and technology leadership (Li, Lam & Qian, 2000; Danneels, 2002; Aydin et al., 2007), broader studies have simultaneously observed business network effect on technology and

innovation success (Pittaway et al., 2004; Ritter & Gemunden, 2004; Zhou, 2010), and recently Wang and Lestari (2013) has observed the role of business network in hi-tech firms in emerging market and highlight that business network is a prerequisite for enhancing NPD through R&D and innovations. Relevant with these, this study defines four factors influencing the NPD success namely business network, product innovation, process innovation, and R&D capability. In short, business network encompasses of research partnership, inter organizational network, and government relationship. R&D capability consists of advance R&D facilities and efficiency. Innovation consists of product innovation (i.e., product planning and quality) and process innovation (i.e., process planning and quality). While the NPD success is measured by NPD launched, time to market, and NPD contribution to firm profit.

2.1. Business Network

Business network is a type of social network whose reason for existing is business activity (Osterle et al., 2001; Lestari, 2014). In emerging market, networking is a prerequisite for hi-tech firm (Wang & Lestari, 2013; Lestari, 2014). In addition to discover opportunities, to the testing the ideas and garner resources (Aldrich & Zimmer, 1986; Lestari, 2013), networking enables a company to establish and enhances relationships with other organizations (Ritter & Gemunden, 2008; Lestari, 2013), and a key determinant to a firm's innovativeness (Zaheer and Bell, 2005; Lestari, 2013).

Therefore, a firm with high level of networking can get better position to find business opportunities and achieve better performance (Lee, Lee, & Pennings, 2001; Lestari, 2013). This study adopts Wang and Lestari (2013) and Lestari (2014) to determine three measure items under business network: government relationship (*guanxi*), in which the government plays as the key stakeholder since it has power to approve projects, allocate resources, and arrange financing and distribution (Luo, 2001); R&D partnership in which the development in network research suggests that knowledge can

be transferred through a firm's alliance network (Powell et al., 1996) to acquire key knowledge (Tsang, 2002); inter organizational network, which covers relationship with enterprises, financial and social institutions (Wang et al., 2008).

2.2. *R&D Capability*

R&D capability defines as the set of organizing processes and principles that a firm uses to deploy its resources to develop new products and improve manufacturing processes in response to the change in external environment (Grant, 2002; Wang & Lestari, 2013; Lestari, 2014). In hi-tech industry firms need to keep accumulating and updating their technological knowledge base through resource, facilities utilization and activities efficiency (Zander and Kogut, 1995; Wang & Lestari, 2013; Lestari 2014). Adopting study from Lestari (2014), this study identifies the R&D capability encompasses of R&D facilities and technology, and its efficiency.

2.3. *Product Innovation*

With respect to Lestari (2014), product innovation is defined as the development of new products, changes in design of established products, or use of new materials or components in the manufacture of established products. Adopting study from Lestari (2014), this study synthesizes that product innovation encompasses of product planning effectiveness and product quality with two reasons. First, Sanders & Mondort (1994) underline the critical of effective product planning to avoid erroneous decisions such as unsuccessful new product idea, and investment losses due to missed investment opportunities.

Here, the planning effectiveness represents the firm ability to develop a clear product portfolio, effective in managing schedule and budget, and ability to elaborate market information into the planning. Second, product quality concerns how good product is, customer needs, robust, and reliable, in which reflected in market share and price that customers are willing to pay (Iamratanaku, Patanakul, & Milosevic, 2008).

2.4. *Process Innovation*

With respect to Lestari (2014), a process innovation is the implementation of a new or significantly improved production or delivery method. In hi-tech industry, process innovation (is a primary source of competitive advantage in which firms that built capabilities to support innovative, fast, efficient, and effective process could introduce new products more quickly, with higher yields and controlled processes that gave them a significant cost advantage over competitors (Roberts, 2004). Adopting study from Lestari (2014), this study defines two measure items for process innovation namely process planning efficiency and process quality. Here, the process planning efficiency represents the firm ability to define a clear target for commercialization/ product launch, reliability of data, and flexibility in any plan changes. While the process quality represents firm ability to develop advance technology and facilities to support manufacturing process, ability to achieve efficiency on machinery and manufacturing process, efficient in production time cycle and budget, and also the qualified human capital.

2.5. *New Product Development*

As NPD plays a critical role in hi-tech firm's performance in emerging market, it should be considered key factors in building and sustaining a competitive advantage (Brown and Eisenhardt, 1995; Rosenthal, 1992; Lestari, 2014). Again, adopting the study from Lestari (2014) this study adopts three items to measure the NPD success namely NPD time to market, new product launched rate, and its contribution to firm profit.

3. *Data Collection*

To conduct 2-sample T test involving 2 groups of firm (older and young firms), a five-part questionnaire (i.e., business network, R&D capability, product innovation, process innovation, and NPD) was developed and sent to high-tech firms in Taiwan on 2013. Using a five-Likert scale respondents were asked to value each factor in term of its effort (scale 1=

to achieve NPD success it doesn't need effort on this factor; scale 2= to achieve NPD success it needs low effort on this factor; scale 3= to achieve NPD success it needs effort on this factor; scale 4= to achieve NPD success it needs high effort on this factor; scale 5= to achieve NPD success it needs a very high effort on this factor/ primary focus of the firm).

While for NPD, this study measured the level of performance for each items in the basis of 5 scales (5=high 1=low performance), then yields the average value from these three items. Totally 13 feedbacks derived from respondents representing semiconductor and telecommunication industry. This study defines 'older' firms as firms with more than 20 years of operating experiences in Taiwan and vice versa. Although with small sample of respondents, to ensure the quality of data this study ensures the respondents are at least in middle to top management level, having knowledge and authority on NPD projects. In general this study derives 7 feedbacks from older firms, and 6 feedbacks from young firms. In term of respondents' profile, 70% are engineering supervisor who responsible for NPD projects, while the remaining 30% are senior engineering supervisor and project supervisor. In total, 40% respondents are representing semiconductor, while 60% are representing telecommunication firms.

4. Finding and Discussion

Before testing the 2-sample T test, a normality test was conducted for each factor in each group. Using Kolmogorov-Smirnov normality test, the null hypothesis is "data are normally distributed" and the alternative hypothesis is "data are not normally distributed." As this study finds P-value greater than 0.05 it can be concluded that both samples are normally distributed. Further, 2-sample T test was conducted to compare two groups of firm. Here, two sample means from older and young firms are compared to discover whether there is no difference between the two population means. The null hypothesis is the population means are the same ($\mu_1 = \mu_2$) and the alternative

hypothesis is the population means are not the same ($\mu_1 \neq \mu_2$). With p value less than 0.05 it is concluded that there is no significant difference between two groups.

Following this process, this study reveals the output from 2-sample T test described in table 1. From the table, firstly this study reveals that under business network competencies *guanxi* (government relationship) shows there is no significant difference between older and young firms. This suggests that government relationship becomes a critical component in NPD where to ensure its success firms have to build strong relationship with government overtime. However, there are significant difference between older and young firms in term of inter organizational and R&D partnership.

From the mean value it shows that young firms need higher effort on these factors. It suggests that as late players, young firms are facing challenges such as competition with existing/ older firms, business environment changes globally. These have led young firms to put higher effort to develop inter organizational and R&D partnership. By these partnerships, young firms can accelerate and speed up the product, process innovation, support R&D activities, and even marketing (in the context of commercialization) since with partnerships firms can gain resource support from its partners.

Secondly, under R&D capability, product innovation and process innovation this study finds no significant differences among two groups. It suggests that overtime firms are struggling to improve their internal R&D and innovation which is driven by complex competition among firms. Thirdly, the NPD success also shows similar result where there is no significance difference. It shows that factor differentiate two groups is the effort in developing business network. Young firms tend to spend more efforts in this factor compare to older firms.

Table 1. Two-sample T test result

Variables	Older (N=7)		Young (N=6)	
	Mean	SD	Mean	SD
<i>Business network competencies</i>				
Guanxi	3.79	0.27	3.83	0.26
Interorganizational network**	2.79	0.39	3.25	0.27
R&D Partnership**	3.43	0.25	3.83	0.28
<i>R&D Capability</i>				
R&D facilities and technology	3.76	0.46	4.22	0.96
R&D efficiency	3.71	0.42	4.13	0.52
<i>Product Innovation</i>				
Effective product planning	4.05	0.36	4.50	0.66
Product quality	3.75	0.29	4.00	0.96
<i>Process Innovation</i>				
Process planning efficiency	3.95	0.36	4.28	1.08
Process quality	3.66	0.49	3.93	1.03
<i>NPD success</i>	3.81	0.41	3.92	0.74
** Difference is significance at the 0.05 level (two-sided)				

5. Conclusion

This study has successfully applied the 2-sample T test to compare two groups of hi-tech firms in Taiwan (older and young firms). In general, it reveals that young firms tend to spend more effort on developing business network to ensure the NPD success compare to older firms, meaning that its critical factor for firm. Meanwhile the other efforts on R&D and product process innovation are not significantly difference. Finally, this study contributes to current literature where it strengthens previous studies from Wang and Lestari (2013) and Lestari (2014) which highlight business network, R&D capability and innovations effect on NPD success and business network is a prerequisite for entry success in a general scope. In term of managerial implications, it suggests that firms need to put more efforts in developing business network to support R&D activities and innovation. Despite of the positive implications, this study has a limitation that this study only involves totally 13 firms, thus further study involving more firms is considered to be important.

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